

## DESIGN AND MANUFACTURING OF MISSILE LONG SHELL COMPONENT BY CNC TURN-MILL CENTRE

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### ABSTRACT

*The main objective of this paper work is to design and manufacture critical component on CNC TURN MILL CENTRE. In this generation of part programme and implementing the same project consists of various operations that are to be performed to complete machining by maintaining the required dimensional accuracy of the component. It also includes holding devices like fixtures to carry out in the processing.*

*The first stage is process plan for identification of required operations and finalization of sequences to complete the job as per drawing requirements. The second stage involves identification of machine tools and machining parameters, work holding devices, cutting toll and other accessories. The third stage involves materials status at every stage from the initial to final product and finding the optimal method. The final stage involves inspection plan of product with suitable inspection method.*

**KEYWORDS:** CNC, Missile, Nose cone, Long Shell & Gyros, etc

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### INTRODUCTION

**Long Shell:** Long Shell is a vital part in Gyro assembly in MILAN Missile. The long shell contains components of outer gimbal, inner gimbal, rotor and short shell gyro drive assembly and other components like outer gimbals. The external gimbals have one level of rotational opportunity and its hub has none. The following internal gimbal is mounted in a spinner, which is a gadget for measuring or looking after introduction, in view of the guideline of precise force. Scientifically, a spinner is a turning wheel or circle in which the hub is allowed to accept any introduction which can be shown in the fig 1. Despite the fact that this introduction does not stay settled, it changes because of considerably less outer torque and an unexpected way in comparison to it would without the huge rakish energy related with the circle's high rate of turn and snapshot of dormancy. The gadget's introduction remains settled, paying little heed to the mounting stage's movement, since mounting the gadget in a gimbal limits outer.



**Figure (a): Long Shell of a Missile**

## PROBLEM DEFINITION

Milan is a family of a medium range anti-tank missiles developed by euro missile, a joint venture between Germany and France to be employed by two men or mounted on round vehicles. It was introduced in 1970.

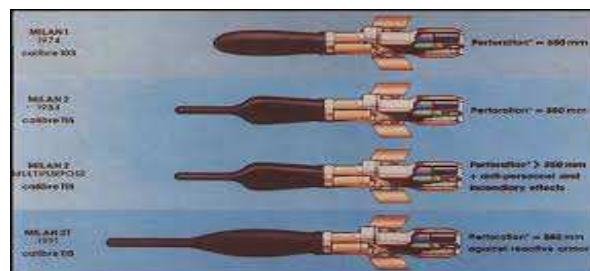
The long shell contains with components of outer gimbal, inner gimbal, rotar and short shell gyro drive assembly and other components, external gimbal have one level of rotational flexibility and its hub in its own plane controlled by the help. This external gimbal has one level of rotational flexibility and its hub has none.

The following internal gimbal is mounted in a whirligig is a gadget for measuring or keeping up introduction in view of the guideline of precise energy. Mechanically, a whirligig is a turning wheel or circle on which the hub is allowed to expect any heading.

Gyroscope in view of other working standards likewise exist, for example, the electronic, microchip bundled MEMS spinners gadgets found in buyer electronic gadgets, strong state ring lasers, fiber optic whirligigs, and the outside delicate quantum whirligig. Uses of whirligigs incorporate inertial route frameworks where attractive compasses would not work. Because of their exactness, gyrotors are likewise used to keep up heading in burrow mining.

**Table 1: Specifications of Milan 2T**

| Dimensions        | ¢125mm                   |
|-------------------|--------------------------|
| Weight            | 11.8kg(26lb)             |
| War head          | 2.7kg(6.0lb)             |
| performance       | Max range 2,000m(6562ft) |
| Min range         | 25mm(8.2ft)              |
| Piercing in armor | 352mm(13.86in)           |
| Top speed         | 200mps(0.60mach)         |



**Figure (b): Milan Missile**

The Indian army has placed an order of 4,100 French origins MILAN 2T ANTI-TANK guided missiles (ATGMs). the entire procurement plan of these ATGMs which is to the tune of \$12million has been cleared by the Indian defense ministry due to the rising between Indian and Pakistan.

## DEVELOPMENT OF MACHINE TOOLS

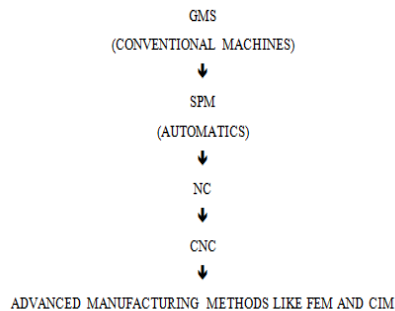
### Introduction

For surviving in the market, the fundamental thought process should be strategized. Improved administrations should be developed to plan, solid, enhanced assembling. Efficiency and effectiveness in assembling will also benefit the sales.

Profitability is a positive distinction amongst yield and information. To build the profitability in this way, one

needs to expand the yield and keeping in mind that keeping the contribution as low as could be expected under the circumstances.

Evolution of the machine tool science is shown in the figure below. Though there is a rapid growth in the machine tool technology and invention of automatic computer aided manufacturing machines, the importance of conventional machines cannot be neglected in production technology.



### **Comparison of General Purpose, Special Purpose & Computer Numerical Control Machines**

**General Purpose Machine** – conventional type.

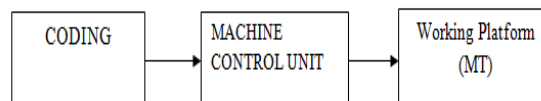
**Special Purpose Machines** – fully automated /bulk manufacturing/ modification is merely impossible.

**CNR** - fully supportive/ desirable to batch manufacturing /Job manufacturing may be some times convenient.

### **Computer Numerical Control of Machine Tools**

The use of super computers in controlling the machines and making them operate on the program prepared by the part programmer is known as CNC. This CNC cannot be accomplished alone with the super computers and it need the combination and co-ordination of servo motors, actuators, supply chains and the tape reader/ buffer memory. The main advantage of CNC over NC is the elimination of tape reader and the program once copied in the buffer memory can be recalled anytime whenever it is used and can be modified then and there itself

### **Elements of NC**



### **CODING**

The coding is a brief sequential order of procedure of machining operation MT has to follow.

### **MCU**

This comprises programmed electrical components which read and interpret the coding & convert into physical operations of the MT.

### Working Platform (MT)

This is the tool which does all the physical work on the work piece

### OPERATING PRINCIPLE

|                           |                                |
|---------------------------|--------------------------------|
| Conventional Machine Tool | - Numeric Control MT           |
| Human Mind                | - NC Controller                |
| Arms                      | - Direct Control Servo Drivers |
| Monitoring System         | - Feedback System              |

### CNC PROGRAMMING

#### Introduction

A program of coding for a Numerical Control MT is a part program. A Numerical Control part program is a progression of coded guidelines that direct the operation of a NC machine. This guideline contains all the machine and control capacities important to influence the machine to play out a particular assignment. The program is set up by posting arranged values. The directions are suffixed with random codes for starting the machine device like begin, stop and so on

#### Part Programmer's Job

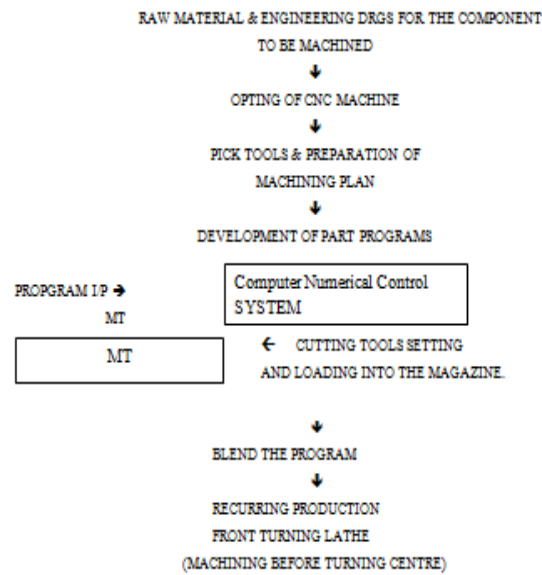
- Study the pertinent part drawing altogether
- Examines the kind of material to be operated
- Determines the determinations and elements of MT and highlights of the Computer Numerical Control framework
- Shows the machining instructions for the activity/apparatus mix
- Coding for the part will be finished

When the part program is being prepared, rely on ease of the highlights in the programming language, the beneath demonstrated system are the mix of various highlights can be utilized profitably relying upon the measure of material to be expelled machining arrangement. A portion of the Computer Numerical Control framework highlights are stored

#### Job Part Dimensioning & Input Method

Fixed measurement methods info is utilized as a part of Computer Numerical Control. It should be modified to FPS i.e. inch co-ordinate framework by doling out G70 Code.

## STEPS INVOLVED IN MACHING OPERATION



## ABOUT THE COMPONENT

### Required Material and Design Specification

#### AL ALLOY DIA 42MM

It is vital part in an explosive assembly which in turn assembled in to an anti tank wire guided missile. It forms as housing and acts as support to the GYRO ASSEMBLY and is assembled to GD Housing.

Upon ignition of explosives, due to the hot pressurized gases, thrust will be given to the initial moment of the missile. This gyro assembly will give the exact direction to the missile. This gyro assembly consists of rotor which rotates at high speed. Being an aluminum alloy the strength to weight ratio is more thereby no oxidation formation or rust formation occurs. During its functioning, it can even withstand very high pressures.

### Sequence of Operations

The sequence of operation performed on CN machines for the manufacturing of a Long shell are:

- Cutting
- Turning
- Drilling
- Boring
- Finish bore
- Deburring
- Counter shrinking
- Trepanning&

- Tapping

**Table 2: Inspection Details**

| Dimension                 | Actual Reading after Machining | Gauges, Instruments  |
|---------------------------|--------------------------------|----------------------|
| Dia31(+0.1,-0.2)          | 30.85                          | Intrapid             |
| Dia32H7                   | 32.05                          | STD PPG              |
| 0.8(+/-0.05)              | 0.81                           | Depth dial           |
| Dia6(+0.014,0.008)        | 6.012                          | Ppg/bore dial        |
| 2.2(+0.3)                 | 2.45                           | Micrometer           |
| Dia33(+0.1)               | 33.5                           | Comb.fix./micrometer |
| 1.5(+/-0.1)               | 1.5                            | Vernier/ micrometer  |
| 36(+0.5)                  | 36.3                           | Vernier/ micrometer  |
| Dia7(-0.1)                | 6.95                           | Trep gauge           |
| Dia8.7(+0.1)              | 8.75                           | Trep gauge           |
| 1.6(+/-0.1)               | 1.5                            | Comparator           |
| Pcd 28.(+/-0.05)          | 28.35                          | Position gauge       |
| 62deg(+/-10mints)         | 62                             | Position gauge       |
| 59 deg(+/-10mints)        | 59                             | Microscope/3D        |
| Dia17(+/-0.2)             | 17                             | Vernier              |
| PERP0.02                  | 0.02                           | Dialing              |
| 90deg(+/-30')             | 90                             | Microscope           |
| Dia31.5H7                 | 31.55                          | Std ppg              |
| 42.5(+0.1/-30)            | 42.4                           | Combo fixture        |
| 0.2(+/-0.1)*45deg(+/-deg) | 45                             | Microscope           |
| Flatness0.02              | 0.2                            | Dialing              |
| Check plating thickness   | 3 to 6 microns                 | Fisherscope, visual  |

## CNC Machine

### Specifications of GE42 NC

|                 |                        |
|-----------------|------------------------|
| Type of machine | : CNC TURN MILL CENTRE |
| Make            | : INDEX                |
| Type            | : GE 42 NC             |
| Type of Control | : CNC FAGOR control    |

### TECHNICAL DETAILS

|                       |                     |
|-----------------------|---------------------|
| Turning Diameter      | : 370mm             |
| Turning Length        | : 400mm             |
| Control               | : FAGOR CONTROL     |
| Spindle Bore          | : 52mm; 160mm; 42mm |
| Centre distance       | : 340mm             |
| Total Power Required  | : 22,00kW           |
| Weight of the machine | : 290 tons          |
| Dim.s of the Machine  | : 500x200xH180 cm   |



**Figure (c): CNC Milling**

## CONCLUSIONS

The project is all about geometric modeling of the component which is to be manufactured and a well defined procedure has been adopted for the production of the component so designed. The component is long shell, which is mainly used in the MILAN-2T missile.

This component plays a very important role in the guiding the missile direction. Manufacturing of such component requires a precision of about 6 microns, which can be achieved using only precision machining equipments like CNC. Once the setting time is done, any number of components can be manufactured in a single step. Hence, the machining time is reduced. Reduction of cycle in the manufacturing of the component has been achieved by introducing cycles feed and speed rate and also by using latest tools. The production quality of the component improved a lot due to controlled dimensional accuracy.

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